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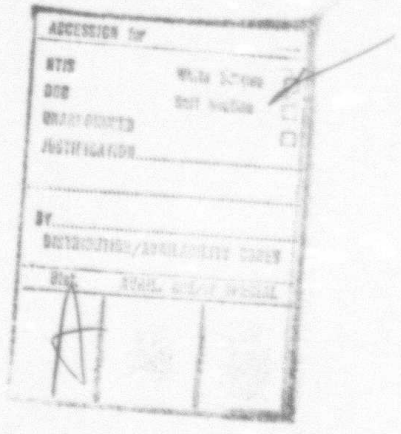

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User-interaction, models, Europe, Middle East, Latin America, Africa, regime change, United States, Soviet Union, People's Republic of China, preprocessor, forecasting model, post-processor.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report contains all system documentation for four regional forecasting models (Europe, Middle East, Latin America, and Africa). The document containing the three computer programs that comprise the regional forecasting system. The programs and annotated passion to enable a better understanding to its logic and structure.

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WASHINGTON, D.C. OFFICES

FINAL TECHNICAL REPORT

DEVELOPMENTAL METHODOLOGIES FOR MEDIUM- TO LONG-RANGE ESTIMATES: PROGRAM DOCUMENTATION FOR LONG-RANGE REGIONAL FORECASTING MODELS (U)

September 1976

Sponsored by:

Defense Advanced Research Projects Agency

ARPA Order Number	3233
Program Code Number	P6W10
Contractor	CACI, Inc. -Federal
Effective Date of Contract	March 1, 1976
Expiration Date of Contract	September 30, 1976
Amount of Contract	$135,337
Contract Number	MDA903-76-C-0255
Principal Investigator	Dr. John J. McIlroy (703) 841-7800

PREFACE

This document is one of a series of reports describing the research activities undertaken to complete Defense Advanced Research Projects Agency (ARPA) supported contract number MDA903-76-C-0255, entitled "Developmental Methodologies for Medium- to Long-Range Estimates." These reports describe the project's empirical, methodological, substantive, technical, and theoretical contributions.

The Final Technical Report is presented as a set of documents rather than a single report. They are

- Executive Summary,
- Long-Range Regional Forecasting Models,
- The Soviet Force Effectiveness Model,
- *User's Manual for the Long-Range Regional Forecasting* Models,
- User's Manual for the Soviet Force Effectiveness Model, and
- Program Documentation for the Soviet Force Effectiveness Model.

The first three volumes substantively describe all research tasks, provide the rationale for research decisions, and report important findings. The remaining four volumes document the two computer programs delivered to the Defense Intelligence Agency/Directorate for Estimates (DIA/DE) for installation on the Defense Intelligence Agency On-Line System (DIAOLS).

The Executive Summary briefly describes the overall project. The volumes on the regional forecasting model and the force effectiveness model, by far the most substantive and complex of the documents, discuss the design and development of each of these models, respectively. The first reviews the regional models, identifies areas where improvements were made for DIA/DE, and presents the findings from sensitivity tests and computer simulations for Europe, the Middle East, Latin America, and Africa. The second fully discusses the development of the Soviet force effectiveness model. The volume is classified.

The remaining four volumes focus on the two computer models delivered to DIA/DE. A user's manual and program documentation have been written that provide all necessary information for using and maintaining the models.

ACKNOWLEDGEMENTS

This report was prepared by:

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Leo Hazlewood, Ph. D.
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PROJECT OVERVIEW

This User's Manual describes one of two important analytical technologies developed for the Defense Intelligence Agency/Directorate for Estimates (DIA/DE) under Defense Advanced Research Projects Agency (ARPA) Contract No. MDA903-76-C-0255, designed to improve the capability to forecast important factors that define the international military environment and have implications for long-range intelligence estimates. Two user-interactive computer models were developed in this project. The first enhances existing Department of Defense forecasting capabilities (CACI, 1975b, 1974, 1973) by applying social science research methodologies to long-range forecasting of important economic, military, and political variables. The second major product is a model that enables DIA/DE to measure total Soviet force effectiveness for use in estimative intelligence. Together, these efforts constitute technological innovations that enhance the reliability, accuracy, relevance, timeliness, and, therefore, the credibility of long-range forecasting for defense intelligence estimates and planning. This manual describes the user-initiated procedures for the regional long-range forecasting models.

This project had four objectives:

1. Refine and equalize the existing long-range forecasting models for Europe, the Middle East, Latin America, and sub-Saharan Africa, previously developed under ARPA contracts for the Joint Chiefs of Staff (JCS/J-5).

2. Enrich the existing models by including the People's Republic of China as a major actor in the superpower simulation capability and adding the option to simulate the impact of political regime changes.

3. Develop a model to estimate future Soviet force effectiveness based on the Defense Intelligence Projections for Planning (DIPP) document, including the capacity of the Soviet Union to improve the quality and quantity of its major weapon systems and pose increased threats to U.S. interests.

4. Implement the enriched forecasting models and the Soviet force effectiveness model on the Defense Intelligence Agency On-Line System (DIAOLS) with a user-interactive capability to permit DIA analysts to forecast alternative futures by altering data, superpower behavior, or regime type, and/or forecasting parameters to simulate different courses of action.

ACCOMPLISHMENTS

All phases of the research were completed so that offices with established DIAOLS linkages can access either the CACI regional forecasting models or the Soviet force effectiveness model. As proposed,

- The regional forecasting models have been standardized at comparable complexity for Europe, the Middle East, Latin America, and sub-Saharan Africa, and China has been added to the superpower influence set;

- The capability to influence forecasts by simulating regime changes was added and the models were made user-interactive;

- Sensitivity tests and simulations have been performed with each of the models, and the three programs associated with the regional forecasting models (the preprocessor, forecasting program, and report generator) have been installed on DIAOLS;

- The Soviet force effectiveness model has been developed using information available in the DIPP on the number and characteristics of Soviet weapon systems;

- An equation was developed that selectively aggregates weapon characteristics, interfaces them with DIPP force level information, and generates estimates of Soviet force effectiveness;

- A program for the Soviet force effectiveness model that permits user-interaction with the weapons system data and alternative assumptions about the growth and structure of Soviet forces has been implemented on DIAOLS and is presently available.

The two computer models considerably enhance DIA/DE's forecasting capability, as intelligence estimators can now generate and analyze long-range alternative futures for Europe, the Middle East, Latin America, and Africa, or alternative estimates of Soviet force effectiveness. In each case, the analyst has available a computer technology that permits structures and assumptions of either model to be altered to reflect an insight about the phenomenon being studied. Furthermore, the intelligence estimator has guidelines on how to interface the long-range regional forecasts with estimates of total Soviet force effectiveness. As analysts become more familiar with both models, their sensitivities to the implications of the generated forecasts and estimates will increase. More questions will eventually be asked that will tax the limits of the models. Finally, as they gain currency throughout the intelligence community, demands for increased sophistication and refinement can be expected.

The models produced by this research integrate traditional academic approaches and complex quantitative methodologies to develop tools that can improve intelligence estimates. In addition, the research interfaced qualitative and quantitative techniques that are intermingled in any modeling effort. It also produced vastly improved, standardized, and user-interactive versions of CACI's regional forecasting models.

Moreover, it produced the first generation of a user-interactive Soviet force effectiveness model that relies on highly sophisticated intelligence data. The lessons learned in completing these two major efforts should be intensely scrutinized by potential users.

CACI's past efforts in developing the regional forecasting models have involved collecting and organizing statistical information, applying statistical analytical techniques, examining the implications of data error, designing and constructing forecasting models, designing and developing user-interactive programs, applying regional versus country-specific forecasting equations, and so on. Each effort has clearly improved the reliability and validity of the regional forecasting models, thus advancing considerably the credibility of forecasts.

Even with these advances, continuing technology assessments suggest a number of unmet, yet very necessary, steps which must be taken to ensure that the best possible regional models are developed for the national security community. Some of these are

- Develop worldwide medium- to long-range estimative intelligence technologies. Currently, no model exists for Asia. Limited effort would be required to expand the current system to include that region. Further, the current structure contains the United States, the Soviet Union, and the People's Republic of China as influential superpowers. This set could, and should, be expanded to include Japan and the major Western European countries.

- Develop stochastic mechanisms for superpower interaction simulation. While including additional superpower influences is a substantial step toward improving the realism of a worldwide model, only the independent

effects of the superpowers will have been modeled. The action-reaction nature of superpower behaviors and the impacts of such activity on other nations can now only be indirectly simulated. These aspects can and should be modeled in greater detail.

- Explore and apply methodologies to enrich regional forecasts. Constraining the analyst's perspective to define sets of countries geographically has, to some extent, made modeling more difficult. One solution is to estimate country-specific parameters, an approach that has worked extremely well with the economic sector of the current model. However, when data are insufficient or inadequate, the relationships among environmental variables should be modeled for similar types of countries. These procedures should produce increasingly accurate forecasts.

The lessons learned from modeling Soviet force effectiveness should also be intensely evaluated. As expected, the data in the DIPP are more readily available for larger weapons. Consequently, a force effectiveness model favoring the available data was developed. Thus, the effectiveness of general purpose forces (naval, tactical air, and ground) is less well assessed by the current model. During the project, CACI continually clarified DIA/DE's specific interests on Soviet force effectiveness. For example, the distribution of off-line and on-line systems became important, as did the distinction between nuclear and non-nuclear weapons. Furthermore, distinctions as to the role of specific weapons (either offensive or defensive) sometimes became important in considering weapon effectiveness.

The current Soviet force effectiveness model discriminates between nuclear and non-nuclear weapons and off-line and on-line systems. It is also capable of aggregating different weapon systems to simulate specific missions. Other advances can readily be made.

- Identify forces by geographical region, permitting combinations of offensive and defensive capabilities in specific locations such as Europe, South Asia, and China.

- Evaluate Soviet force effectiveness of weapons in both an offensive and defensive role. This would considerably enhance the intelligence estimator's knowledge of the dimensions of force effectiveness and the overall effectiveness of specific forces analyzed in the DIPP.

- Develop measures of U.S. force effectiveness for offensive and defensive systems, located in selected geographical areas, to compare with Soviet force effectiveness measures. Such an analysis could eventually develop new technologies for quantitative net assessment.

Technology assessment is an ongoing process in which model builders and model users review and try to improve the range and quality of existing products. CACI's long-range forecasting models have been subjected to precisely this kind of scrutiny. This discussion identified new areas where further improvements should be made. The same is true of the Soviet force effectiveness model. As more users become acquainted with it, technology assessment will begin. The resulting feedback will contribute to the growth that must continue if forecasting and estimation capabilities within the Department of Defense are to become part of the policy-planning process in the national security community.

PREPROCESSOR

The preprocessor:

- Reads country attribute data and model parameters from the input file;
- Accepts and stores user-specified changes in country attribute data and model parameters;
- Prompts the user so that there is no need to remember the order in which entries must be made; and
- Continues to store the permanent data file, retaining user-specified changes in a temporary file for processing during a run of the model.

The program requires two stored files and one output file. The terminal is also used for input and output.

- File 8. The permanent data file - one for each region. Stored under the names: 'LATA,' 'EURO,' "AFRI,' 'MEST.'
- File 2. The dictionary file - contains attribute and dependent variable names and messages to be printed during program execution. Stored under the name 'DICTY.'
- File 3. The change file - written by this program to be used as input to the forecasting model program. Saved under the name 'MODF.'

DECLARATION STATEMENTS

```
00110 COMMON/NAM/M,KODC(30),KODR(4),IAL(30),ITR(30),IVT(30)
00120 DIMENSION NAMC(30),ITITLE(4)
00130 COMMON/ATT/CHA(30),CHC(30),CHM(5,30),CHT(5,30),GOV(30),KAD(30)
00140&,SUA(30),SUC(30),SUM(5,30),SUT(5,30),USA(30),USC(30),
00150&USM(5,30),UST(5,30),CNF(2,30),CNS(2,30),COU(5,30),DEX(3,30)
00160&,GDP(4,30),INV(2,30),TEX(2,30),TIM(2,30),TML(2,30)
00170 COMMON/ABC/A(6,72),B(5,30),C(3)
00180 COMMON/ONE/MLM(2,30),PDP(4,30),VTR(2,30),TRD(30),
00190&VUS(30),VSU(30),VCH(30),TR(30)
00200 COMMON /MODF/ MOD(5,50),XMOD(2,50),LC,IST,NYR
00210 COMMON /BKP/ LA,LISTA(23),MUL(23),NUM(23),LV,LISTV(21),
00220&IEQ(34,18),IXQ(16)
00221 COMMON DUMMY(36),IFLAG,ISRT,IPMAX
00230 DIMENSION MA(5),MB(2),M1(6),M2(5),M3(5),M4(6),M5(8),M6(10),M7(2),
00240&M8(13),M9(12),M10(10),M11(8),M12(9),MM12(11),MM45(14)
00250&,Q(1860),Q1(720),Q2(390),LIST(10),IQN(125),XQ(585),IW(4)
00251&,X(5),LREGION(4)
00260 CHARACTER *4 HELP,ALL MA,MB,NO,NONE,KEND,NAMC,LISTA,ITITLE,LISTV
00261&,M1,M2,M3,M4,M5,M6,M7,M8,M9,M10,M11,M12,MM12,MM45,IEQ,IXQ,LREGION
00262&,N1,N2,IAS,J4,INS
00263 CHARACTER *11 DFILE
00266 CHARACTER *1 N,E,H,LIST,CKY,CKX,IG,IA
00267 CHARACTER *1 IE,IH
00268 CHARACTER *10 IFILE
00269 CHARACTER *4 IREG
00270 REAL MLM,MLA,INV,KAD
00280 EQUIVALENCE (CHA(1),Q(1)),(M1(1),MM12(1)),(MM45(1),M4(1))
00290&,(M2(1),MM12(7)),(M5(1),MM45(7))
00300&,(M,IQN(1)),(A(1,1),XQ(1)),(Q1(1),CNF(1,1)),(Q2(1),MLM(1,1))
00310 DATA NUM/1,1,5,5,1,1,1,1,5,5,1,1,5,5,2,2,5,3,4,2,2,2,2/
00320 DATA MA/4HENTE, 4HR RE, 4HGION, 4H COD, 4HE,   /
00330 DATA MB/4HFILE, 4H OK  /
00340 DATA NA,NB,NC,LA,LV,IST,MXC/72,5,3,23,21,1970,50/
00350 DATA IW/0,8,12,16/
```

```
00360 DATA NO,NONE,KEND,N,IE,IH/4HNO  , 4HNONE, 4HEND , 1HN, 1HE, 1HH/
00365 DATA HELP,ALL/4HHELP,4HALL /
00370 DATA LIST/1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9,1H0/
00371 DATA LREGION/4HEURO,4HLATA,4HMEST,4HAFRI/
```

The arrays in which the changes will be stored are set to zero.

```
00380 DO 292 I=1,NA
00382 DO 292 J=1,6
00383 292 A(J,I)=0,
00390 DO 298  I=1,MXC
00400 DO 296  J=1,5
00410 296 MOD(J,I)=0
00420 DO 297  K=1,2
00430 297 XMOD(K,I)=0,
00440 298 CONTINUE
```

The factor used in determining the Q-ARRAY INDEX is computed.

```
00450 MUL(1)=0
00460 DO 2  J=2,LA
00470 2 MUL(J)=MUL(J-1)+NUM(J-1)
```

The input file, 'IREG,' is retrieved.

```
00480 3 PRINT 1,MA
00490 1 FORMAT(6X,18A4)
00500 4 READ 5,IREG
00510 5 FORMAT(A4)
00520 IF (IREG.NE.HELP) GO TO 7
```

```
00530  PRINT," REGION CODES ARE: EURO,LATA,MEST,AFRI "
00550 GO TO 4
00552 7 DO 71 IJ=1,4
00553 71 IF (IREG.EQ.LREGION(IJ)) GO TO 72
00554 PRINT,"ERROR IN REGION CODE"
00555 GO TO 6
00556 72 GO TO (73,74,75,76),IJ
00557 73 IFILE="DIPP/EURO;"
00558 GO TO 77
00559 74 IFILE="DIPP/LATA;"
00560 GO TO 77
00561 75 IFILE="DIPP/MEST;"
00562 GO TO 77
00563 76 IFILE="DIPP/AFRI;"
00564 77 CALL SUBATT(8,IFILE,1,0,ISTAT)
00580 IF (ISTAT) 6,8,6
00590 6 PRINT 1001, MA
00600 1001 FORMAT(1X,10HERROR, RE- , 5A4)
00610 GO TO 4
```


The file heading is checked. If wrong file is found, the file retrieval section is repeated.

```
00620 8 READ (8,1,ERR=6) (ITITLE(LLL),LLL=1,4)
00630 PRINT 1,ITITLE
00640 PRINT,"IS THIS FILE OK "
00650 READ 5,INS
00660 IF (INS.EQ.NO)  GO TO 3
```

The number of countries and number of years for prediction are read. The final year NYR is set.

```
00670 READ (8,1002) M,KREG,NY
00680 1002 FORMAT(7X,I2,1X,I2,1X,I2)
00690 NYR=NY+IST
```

Data for the major powers are read.

```
00710 1003 FORMAT(6X,9F8.1)
00720 2004 FORMAT(6X,I2,1X,5F8.1)
00730 DO 10  I=1,M
00732 READ (8,2002) USC(I),SUC(I)
00734 2002 FORMAT(10X,F3.0,5X,F3.0)
00736 READ (8,2003) CHC(I),USA(I),SUA(I),CHA(I),UST(1,I),SUT(1,I),CHT(1,I)
00738 READ(8,1003) USM(1,I),SUM(1,I),CHM(1,I),UST(2,I),SUT(2,I),CHT(2,I)
00739&,USM(2,I),SUM(2,I),CHM(2,I)
00740 READ(8,1003)UST(3,I),SUT(3,I),CHT(3,I),USM(3,I),SUM(3,I),CHM(3,I)
00741&,UST(4,I),SUT(4,I),CHT(4,I)
00742 READ(8,1003)USM(4,I),SUM(4,I),CHM(4,I),UST(5,I),SUT(5,I),CHT(5,I)
00743&,USM(5,I),SUM(5,I),CHM(5,I)
00750 10 CONTINUE
00751 2003 FORMAT(22X,7F8.1)
```

Country attribute data are read.

```
00758 DO 12 I=1,M
00759 READ (8,1004) NAMC(I),KGV,KAD(I)
00760 READ (8,3001) (POP(J,I),J=1,3)
00762 READ (8,1003) (GDP(J,I),J=1,3),CNS(1,I),INV(1,I),(DEX(J,I),J=1,2)
00763&,TIM(1,I),TEX(1,I)
00765 READ (8,3003) MLM(1,I),VTR(1,I),CNF(1,I),(TML(J,I),J=1,2)
00767 READ (8,3004) VUS(I),VSU(I),VCH(I)
00769 READ (8,3005) (CDU(J,I),J=1,5)
00770 3001 FORMAT(6X,F7.0,3X,F7.0,5X,F7.0)
00772 3003 FORMAT(6X,3F8.1,2F8.4)
00773 3004 FORMAT(6X,3F8.1)
00774 3005 FORMAT(6X,5(F5.3,5X))
00780 1004 FORMAT(6X,A4,I1,1X,F2.0)
00785 GOV(I)=KGV
00820 POP(3,I)=POP(3,I)*100.
00830 12 CONTINUE
```

Model parameters are read.

```
00840 READ (8,1003) (A(6,J),J=1,NA)
00850 DO 16  J=1,M
00860 16 READ (8,1003) (B(K,I),K=1,NB)
```

The dictionary file is retrieved and read beginning with the list of country attributes and dependent variables and then the equations and message arrays.

```
00870 DFILE="DIPP/DICTY;"
00880 CALL SUBATT(2,DFILE,1,0,ISTAT)
00890 READ (2,1) LISTA
00900 READ (2,1) LISTV
00910 DO 18  J=1,34
00920 18 READ (2,1) (IEQ(J,L),L=1,18)
00930 READ (2,1) IXQ
00940 READ (2,1) MM12
00950 READ (2,1) M3
00960 READ (2,1) MM45
00970 READ (2,1) M6
00980 READ (2,1) M7
00990 READ (2,1) M8
01000 READ (2,1) M9
01010 READ (2,1) M10
01020 READ (2,1) M11
01030 READ (2,1) M12
```

Also included in the DICTY file are major power GDP's, growth rates, and finally, the global parameters to be used in cases of a government change.

```
01032 READ (2,1003) C
01034 READ (2,1003) USG,SUG,CHG
01035 19 READ (2,2004) IU,(X(L),L=1,5)
01036 IF (IU.EQ.0) GO TO 90
01037 DO 20 L=1,5
01038 20 A(L,IU)=X(L)
01039 GO TO 19
```

Beginning of the change entries: first, the country attributes:

```
01040 90 LC=1
01050 100 PRINT 1,MM12
```

The country code is read and the country located in the dictionary list, 'NAMC.'

```
01060 110 READ 5,N1
01070 IF (N1.EQ.NO.OR.N1.EQ.NONE.OR.N1.EQ.KEND) GO TO 200
01080 CALL FIND(M,NAMC,N1,KC,KOD1)
01090 IF (KOD1-2)  130,120,120
01100 120 PRINT 1,M2
01110 GO TO 110
```


The attribute name is read, and the attribute is located in the dictionary list, 'LISTA.'

```
01120 130 PRINT 1,M3
01130 READ 5,N2
01140 IF (N2.EQ.NO.OR.N2.EQ.NONE.OR.N2.EQ.KEND)  GO TO 100
01150 CALL FIND(LA,LISTA,N2,KA,KOD2)
01160 IF (KOD2-2)  150,130,130
```

The equivalent location in the Q-ARRAY is computed for this attribute and the current value retrieved.

```
01170 150 IN=MUL(KA)*30+NUM(KA)*(KC-1)+1
01180 GO=Q(IN)
```

Subroutine CHNG is called to read in the new value and to store the change information.

```
01230 CALL CHNG(0,QQ,KC,KA,IN,NAMC,M)
```

If the maximum number of changes has been reached, no more may be entered.

```
01240 IF (LC-MXC) 130,130,290
```

Changes in the model parameters. The name of the dependent variable is read and located in the dictionary list, 'LISTV.'

```
01250 200 PRINT 1,MM45
01260 210 READ 5,N1
01270 IF (N1,EQ,NO,OR,N1,EQ,NONE,OR,N1,EQ,KEND) GO TO 300
01280 CALL FIND(LV,LISTV,N1,KV,KOD1)
01290 NV=KV
01300 IF (KOD1-2) 212,220,220
01310 220 PRINT 1,M5
01320 GO TO 210
```

The equation for the dependent variable is printed.

```
01330 212 IF (KV,LE,11) GO TO 222
01340 IF (KV,LE,18) GO TO 213
01350 KV=KV+13
01360 GO TO 222
01370 213 IF (KREG-2) 214,216,216
01380 214 IF (KV,EQ,18) GO TO 220
01390 GO TO 222
01400 216 IF (KV,EQ,17) GO TO 220
01420 IF (KV,EQ,16,OR,KV,EQ,18) GO TO 222
01440 218 KV=KV+IW(KREG)
```

```
01450 222 PRINT 1005, N1,(IEQ(KV,L),L=1,18)
01460 1005 FORMAT(1X,A3,4H(T)=,15A4/8X,10A4)
01470 IF (KV-9)  224,223,224
01480 223 PRINT 1006,IXQ
01490 1006 FORMAT(8X,16A4)
```

The user is asked for the number of the parameter to be changed.

```
01500 224 PRINT 1,M6
01510 READ 1007,CKX,CKY
01520 1007 FORMAT(2A1)
```

To allow the user to ask for 'HELP,' the parameter number is read as two ALPHA characters; they must be converted to integers.

```
01530 IF (CKX.EQ.N.OR.CKX.EQ.IE) GO TO 220
01540 IF (CKX.EQ.IH) GO TO 227
01550 DO 225  J=1,10
01560 IF (CKX.EQ.LIST(J)) GO TO 228
01570 225 CONTINUE
01580 226 PRINT 1,M7
01590 227 PRINT 1,M8
01600 GO TO 224
01610 228 IF (J.EQ.10)  J=0
01620 MX=10*J
```

```
01630 DO 229  J=1,10
01640 IF (CKY.EQ.LIST(J)) GO TO 230
01650 229 CONTINUE
01660 GO TO 226
01670 230 IF (J.EQ.10)  J=0
01680 KY=MX+J
```

The first five dependent variables are computed from country-specific parameters. The country code must be entered and the county list searched.

```
01690 IF (KV-5) 231,231,238
01700 231 IF (KY-NB)  232,232,226
01710 232 PRINT 1,M9
01720 234 PRINT 1,M2
01730 READ 5,N2
01740 IF (N2.EQ.NO.OR.N2.EQ.NONE.OR.N2.EQ.KEND) GO TO 224
01750 CALL FIND(M,NAMC,N2,KC,KOD2)
01760 IF (KOD2-2) 236,234,234
```

The old parameter value is stored in local variable 'XX' and Subroutine 'CHNG' is called to handle the change.

```
01770 236 IF (KY-NB) 237,237,226
01780 237 XX=B(KY,KC)
01790 J=2
01800 GO TO 250
01810 238 IF (NV-18) 240,240,242
01820 240 IF (KY-NA)  241,241,226
01830 241 XX=A(6,KY)
01840 J=1
01850 GO TO 250
01860 242 IF (KY-NC)  244,244,226
```

```
01870 244 XX=C(KY)
01880 J=3
01890 250 IF (XX) 254,252,254
01900 252 PRINT 1010,IREG
01210 1010 FORMAT(41H THIS TERM IS NOT A PREDICTOR FOR REGION ,A4)
01910 GO TO 224
01920 254 CALL CHNG(J,XX,KC,NV,KY,NAMC,M)
```

If program control is transferred to statement 290, the user has entered the maximum number of changes. Normally, program control reaches statement '300' when the user has finished. He is given the option of looking at the changes entered.

```
01930 IF (LC-MXC) 260,260,290
01940 260 IF (KV-5)  234,234,224
01950 290 PRINT 1,M10
01960 300 LC=LC-1
01970 IF (LC.EQ.0) GO TO 900
01980 PRINT 1,M11
01990 READ 5,IAS
02000 IF (IAS,EQ,NO) GO TO 410
02010 PRINT 1012
02020 KQ=0
02030 DO 302  J=1,LC
02040 IF (MOD(1,J)) 302,301,302
 02050 301 J1=MOD(2,J)
02060 J2=MOD(3,J)
 02070 IF (J2-6) 310,408,310
 02080 408 IO=XMOD(1,J)
02090 JW=XMOD(2,J)
02100 PRINT 1013,MOD(5,J),NAMC(J1),LISTA(J2),NAMC(IO),NAMC(JW)
02110 GO TO 311
02120 310 PRINT 1014,MOD(5,J),NAMC(J1),LISTA(J2),(XMOD(L,J),L=1,2)
02130 311 KQ=KQ+1
02140 302 CONTINUE
02150 IF (KQ) 303,303,304
02160 303 PRINT 1,NONE
02170 304 KQ=0
```

```
02180 PRINT 1018
02190 DO 308  J=1,LC
02200 J1=MOD(1,J)
02210 IF (J1) 308,308,306
02220 306 J2=MOD(2,J)
02230 J3=MOD(3,J)
02240 J4=4HALL
02250 IF (J1.EQ.2) J4=NAMC(J2)
02260 KQ=KQ+1
02270 PRINT 1016,MOD(5,J),LISTV(J3),MOD(4,J),J4,(XMOD(L,J),L=1,2)
02280 308 CONTINUE
02290 IF (KQ) 410,309,410
02300 309 PRINT 1,NONE
02420 1012 FORMAT(/1X,4HYEAR,1X,4HCNTY,1X,3HATT,8X,3HOLD,8X,3HNEW)
02430 1013 FORMAT(2X,I4,2(1X,A4),2(8X,A3))
02440 1014 FORMAT(2X,I4,2(1X,A4),2F12.2)
02450 1016 FORMAT(2X,I4,1X,A4,2X,I2,3X,A4,2X,2F12.2)
02460 1018 FORMAT(/1X,4HYEAR,1X,5HDFP V,2X,1HP,2X,4HCNTY,
02470&8X,3HOLD,8X,3HNEW)
```


If the user is not satisfied with the changes, they are deleted and he is allowed to start over.

```
02310 410 PRINT 1,MB
02320 READ 5,IAS
02330 IF (IAS.NE.NO) GO TO 900
02340 PRINT 1,M12
02350 DO 318  I=1,MXC
02360 DO 312  J=1,5
02370 312 MOD(J,2)=0
02380 DO 314  J=1,2
02390 314 XMOD(J,I)=0,
02400 318 CONTINUE
02410 GO TO 90
```

If the user is satisfied with the changes, they are written to the Change file to be read and processed during a model run.

```
02474 900 IFILE="DIPP/MODF;"
02475  CALL SUBATT(3,IFILE,3,0,ISTAT)
02480 WRITE (3) KREG,LC,IST,NY,NYR,MOD,XMOD,Q,IQN,XQ,Q2,NAMC
```

Program execution is terminated.

```
02510 STOP
02520 END
```

SUBROUTINE CHNG

This subroutine:

- Reads and checks the new value, and
- Stores the change.

```
02530 SUBROUTINE CHNG(KOD,QQ,KC,KV,IN,NAMC,M)
```

Where:

KOD - zero, for attribute changes; = 1, 2, 3, for changes in A, B, C, parameters, respectively,

QQ - Old value,

KC - Country index (order in dictionary list),

KV - Attribute or parameter index,

IN - Q-ARRAY index (for attribute changes) or parameter number (for parameter changes),

NAME - Array containing country codes,

M - Number of countries in this region.

DECLARATION STATEMENTS

```
02540 COMMON/MODF/MOD(5,50),XMOD(2,50),LC,IST,NYR
02550 DIMENSION NAMC(30)
02560 CHARACTER *4 NAMC
02561 COMMON DUMMY(36),IFLAG,ISRT,IPMAX
02565 CHARACTER *4 IVAL
02570 DATA F/0,1/
```

If the attribute KAD [country's adversary] is to be changed, the new adversary must be read and located in the list of countries.

```
02580 IF (KOD) 26,126,26
02590 126 IF (KV,EQ,5) GO TO 160
02600 IF (KV,NE,6) GO TO 24
02610 128 PRINT 130
02620 130 FORMAT(21H ENTER NEW ADVERSARY )
```

```
02630 READ 132,IVAL
02640 132 FORMAT(A4)
02650 CALL FI    M,NAMC,IVAL,KI,KODA)
02660 IF (KODA-2) 134,128,134
```

The old value is printed. If the change involves a country attribute, any new value is permitted.

```
02670 134 VAL=KI
02680 GO TO 16
02682 24 PRINT 90,QQ
02683 90 FORMAT(19H CURRENT VALUE IS   ,F12.4/16H ENTER NEW VALUE  )
02684 READ,VAL
02685 GO TO 16
```

Upper and lower limits based on the current value are set for the parameters. The new value is read and checked against these limits.

```
02690 26 IF (QQ)  27,28,30
02700 27 XL=QQ*(1.+F)
02710 XH=QQ*(1.-F)
02720 GO TO 8
02730 28 XH=F
02740 XL=-F
02750 GO TO 8
02760 30 XH=QQ*(1.+F) + .000001
02770 XL=QQ*(1.-F)
02780 8 PRINT 1,QQ,XL,XH
02790 1 FORMAT(18H CURRENT VALUE IS  ,F18.6/25H ENTER NEW VALUE BETWEEN
02800&,F18.6,5H AND  ,F18.6)
02810 10 READ, VAL
02820 IF (VAL)  11,16,11
```

```
02830 11 IF (VAL-XL) 14,16,12
02840 12 IF (VAL-XH)  16,16,14
02850 14 PRINT 2
02860 2 FORMAT(29H VALUE OUTSIDE ALLOWED LIMITS  )
02870 GO TO 8
```

The regime type is to be changed.

```
02880 160 PRINT 161
02890 READ,VAL
02900 IF (VAL.LT.6.) GO TO 16
02910 PRINT,"ERROR, REGIME MAY BE 1,2,3,4, OR 5."
02920 GO TO 160
02930 161 FORMAT(22H ENTER NEW REGIME TYPE  )
```

The year in which the change is to become effective is entered.

```
02950 16 PRINT 4
02960 4 FORMAT(22H ENTER YEAR OF CHANGE  )
02970 READ, IYR
02980 IF (IYR-IST)  20,19,19
02990 19 IF (IYR-NYR)  22,20,20
03000 20 PRINT 6
03010 6 FORMAT(14H ERROR IN YEAR  )
03020 GO TO 16
```

The change information is stored in arrays 'MOD' and 'XMOD.'

```
03030 22 MOD(1,LC)=KOD
03040 MOD(2,LC)=KC
03050 MOD(3,LC)=KV
03060 MOD(4,LC)=IN
03070 MOD(5,LC)=IYR
03080 XMOD(1,LC)=QQ
03090 XMOD(2,LC)=VAL
```

The total number of changes entered to this point is increased by 1. Control is returned to the main program.

```
03100 LC=LC+1
03110 RETURN
03120 END
```


SUBROUTINE FIND

This subroutine finds the order, 'KX,' of name 'NAM' in list 'LISTX.'
NX is the number of entries in 'LISTX.'
KOD = 1, 'NAM' found; = 2, 'NAM' not found.

```
03130 SUBROUTINE FIND(NX,LISTX,NAM,KX,KOD)
```

DECLARATION STATEMENTS

```
03131 COMMON DUMMY(36),IFLAG,ISRT,IPMAX
03140 DIMENSION LISTX(NX)
```

```
03145 CHARACTER *4 KELP,LISTX,NAM
03150 DATA KELP/4HHELP/
```

If 'NAM' is 'HELP,' LISTX is printed.

```
03160 IF (NAM.EQ.KELP)  GO TO 20
```

The list, 'LISTX,' is searched for 'NAM.' If 'NAM' is found, the index KX is set to its order in the list. KOD is set to 'J.'

```
03170 DO 10  J=1,NX
03180 IF (NAM.NE.LISTX(J))  GO TO 10
03190 KX=J
03200 KOD=1
03210 GO TO 90
```


If 'NAME' cannot be found, 'LISTX' is printed for the user. KOD is set to 2.

```
03220 10 CONTINUE
03230 PRINT 1,NAM
03240 1 FORMAT(1X,A4,12H NOT IN LIST  )
03250 20 PRINT 2,LISTX
03260 2 FORMAT(22H ALLOWED ENTRIES ARE -  /(10(2X,A4)))
03270 KOD=2
```

Control is returned to the calling routine.

```
03280 90 RETURN
03290 END
```

The forecasting program

- Reads the input file prepared by the preprocessor,
- Accepts user requests for output reports, and
- Computes forecasts, writing each year's values to a temporary storage file.

PROGRAM STATEMENT

The program requires one stored file and one output file. The terminal is also used for input and output.

- File 1. The input file created by the preprocessor. Stored under the name 'MODF'.
- File 2. The output file to be used by the postprocessor. Stored under the name 'OUTP'.

DECLARATION STATEMENTS

```
20 COMMON/NAM/M, KODC(30),KODR(4)
308,IAL(30),ITR(30),IVT(30)
```

```
40 COMMON/ATT/CHA(30),CHC(30),CHM(5,30),CHT(5,30),GOV(30),KAD(30)
50&,SUA(30),SUC(30),SUM(5,30),SUT(5,30),USA(30),USC(30)
60&,USM(5,30),UST(5,30),CNF(2,30),CNS(2,30),COU(5,30),DEX(3,30)
70&,GDP(4,30),INV(2,30),TEX(2,30),TIM(2,30),TML(2,30)
80 COMMON/ABC/A(6,72),B(5,30),C(3)
90 COMMON/ONE/MLM(2,30),POP(4,30),VTR(2,30),TRD(30)
100&,VUS(30),VSU(30),VCH(30),TR(30)
110 COMMON /MODF/ MOD(5,50),XMOD(2,50),LC,IST,NYR
120 COMMON DUMMY(36),IFLAG,ISRT,IPMAX
130 DIMENSION IG(5),IQN(125),Q(1860),Q1(720),Q2(390),XQ(585)
140&,Z(15,15),IZ(3,15),NMC(15),GPOP(30),DPOP(30)
150&,IGC(30),IRIV(25),NAMC(30),LIST(10)
160 REAL MLM,MLA,INV,KAD
170 EQUIVALENCE (CHA(1),Q(1)),(CNF(1,1),Q1(1)),(MLM(1,1),Q2(1))
180&,(M,IQN(1)),(A(1),XQ(1))
190 CHARACTER *4 NAMC,ITITLE,HELP,NO,NONE,END
200 CHARACTER *1 N,IE,IH,LIST
210 CHARACTER *4 NREP,NMC
220 CHARACTER *10 IFILE,OFILE
230 DATA HELP/4HHELP/
240 DATA NO,NONE,KEND,N,IE,IH/4HNO  , 4HNONE, 4HEND , 1HN, 1HE, 1HH/
250 DATA LIST/1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9,1H0/
260 DATA IRIV/3,1,2,2,1,2,3,1,1,2,1,1,1,1,1,2,1,2,1,3,3,1,1,1,3/
270 DATA USG,SUG,CHG/967400.,646100.,1786./
```

IGC, the dummy variable indicating government type, is set to zero.

```
280 DO 10 I=1,M
290 IGC(I)=0
390 10 CONTINUE
```

The change file, 'MODF', is read.

```
400 IFILE="DIPP/MODF;"
410 CALL SUBATT(1,IFILE,1,0,ISTAT)
420 READ (1) KREG,LC,IST,NY,NYR,MOD,XMOD,G,IQN,XQ,Q2,NAMC
```

This section corrects various errors in the input data file.

```
430 DO 12 I=1,M
440 GO TO (7,11,11,8),KREG
450 7 SUT(5,I)=SUT(5,I)*.01
460 GO TO 12
470 8 MLM(1,I)=MLM(1,I)*10.
480 IF (MLM(1,I).EQ.0) MLM(1,I)=4.
490 11 TML(1,I)=TML(1,I)+2.5
500 TML(2,I)=TML(2,I)+2.5
510 12 CONTINUE
```


The current year index, ICUR, is set to the initial year, IST.

```
520 ICUR=IST
```

Subroutine IPUT is called to accept user requests for reports

```
530 CALL IPUT(NAMC)
```

General information is written to the output file, 'OUTP'.

KREG = Region code: 1, Europe; 2, Latin America; 3, Mideast; 4, Africa.

NY = Number of years for the forecast.

IQN = An array equivalent to the common block, NAM. It contains country names and the codes specify the output.

POP = Country population figures for the starting year, 1970.

```
540 OFILE="DIPP/OUTP;"
550 CALL SUBATT(2,OFILE,3,0,ISTAT)
560 WRITE (2) KREG,NY,IQN,(POP(1,I),I=1,30),NAMC
```

This statement marks the beginning of the annual cycle. J2 is the country code to be used later (see lines 780-1050) in transferring current values to the output array.

```
570 18 J2=0
```

The change file is checked. Changes scheduled for this year are made.

```
580 IF (LC.EQ.0) GO TO 31
590 DO 30 I=1,LC
600 IF (MOD(5,I)-ICUR) 30,20,30
610 20 IN=MOD(4,I)
620 IF (MOD(1,I)) 24,22,24
630 22 G(IN)=XMOD(2,I)
640 IF (MOD(5,I),NE.5) GO TO 30
650 I1=MOD(2,I)
660 IGC(I1)=1
670 GO TO 30
680 24 IF (MOD(1,I)-2) 25,26,27
```

```
690 25 A(6,IN)=XMOD(2,I)
700 GO TO 30
710 26 KC=MOD(2,I)
720 B(IN,KC)=XMOD(2,I)
730 GO TO 30
740 27 C(IN)=XMOD(2,I)
750 30 CONTINUE
```

Country attribute values for the current year are written to the output file. For programming efficiency, the values to be stored are transferred to the output arrays Z and IZ.

```
760 31 DO 240 INDX=1,M
765 I=INDX
770 IF (KODC(I)) 240,240,200
780 200 J2=J2+1
790 GXX=CNS(1,I)+INV(1,I)+TEX(1,I)-TIM(1,I)
800 Z(1,J2)=GXX/POP(1,I)
810 Z(2,J2)=INV(1,I)
820 Z(3,J2)=CNS(1,I)
830 Z(4,J2)=TEX(1,I)
840 Z(5,J2)=TIM(1,I)
850 Z(6,J2)=GXX
860 Z(7,J2)=DEX(1,I)
870 Z(8,J2)=MLM(1,I)
880 IF (KREG.NE.4) GO TO 29
890 Z(8,J2)=Z(8,J2)*.01
900 IF (I.EQ.7.OR.I.EQ.18.OR.I.EQ.24) Z(8,J2)=Z(8,J2)*10.
910 29 CONTINUE
920 Z(9,J2)=VTR(1,I)
930 Z(10,J2)=TRD(I)
940 Z(11,J2)=TML(1,I)
950 Z(12,J2)=COU(1,I)
```

```
960 V1=VUS(I)/100.
970 V2=VSU(I)/100.
980 V3=VCH(I)/100.
990 CALL PACK(I,V1,V2,V3,IVT)
1000 IZ(1,J2)=IVT(I)
1010 IZ(2,J2)=ITR(I)
1020 IZ(3,J2)=IAL(I)
1030 Z(13,J2)=DEX(1,I)/POP(1,I)
1040 Z(14,J2)=CNF(1,I)
1050 Z(15,J2)=TR(I)
1060 240 CONTINUE
1080 WRITE (2) IZ,Z
```

If this is the last year, program control passes to statement 9 (line 3750); if not, defense spending is updated and the U.S., Soviet, and Chinese GDP's are recomputed for the current year.


```
1090 IF (ICUR-NYR) 32,9,9
1100 32 ICUR=ICUR+1
1110 DEXN=0.
1120 DEXW=0.
1130 DO 38 I=1,M
1140 DEX(3,I)=DEX(2,I)
1150 DEX(2,I)=DEX(1,I)
1160 38 CONTINUE
1170 USG=USG*C(1)
1180 SUG=SUG*C(2)
1190 CHG=CHG*C(3)
```

NATO and Warsaw Pact defense spending is computed for Europe (Region 1).

```
1200 IF (KREG-1) 41,41,52
1210 41 DO 50 I=1,M
1220 IRV=IRIV(I)
1230 GO TO (42,44,50),IRV
1240 42 DEXN=DEXN+DEX(1,I)
1250 GO TO 50
1260 44 DEXW=DEXW+DEX(1,I)
1270 50 CONTINUE
1280 DEXN=.0331*DEXN
1290 DEXW=.075*DEXW
```

The next section (lines 1300-3510) constitutes the principal part of the forecasting model. It consists of a DO-loop (indexed by I) over all countries in the region.

```
1300 52 DO 130 INDX=1,M
1305 I=INDX
```

The local variable, COUP, is the average for country I over the past 5 years. TMLT is the sum of the past 2 years.

```
1310 JA=6
1320 IF (IGC(I),NE,0) JA=GOV(I)
1330 CC=0,
1340 TM=0,
1350 DO 34  J=1,5
1360 CC=CC+COU(J,I)
1370 IG(J)=0
1380 34 CONTINUE
1390 COUP=0,2*CC
1400 TMLT=TML(1,I)+TML(2,I)
```

The regime type of country I, stored in the array GOV, may take on integer values 1 through 5. The user is given an opportunity to correct errors. There should be no errors of this kind. Should one occur, it may indicate a problem elsewhere. Allowing the user to correct it will permit program execution to continue, although the results may be questionable.

```
1410 K=GOV(I)
1420 36 IF (K.GE.1.AND.K.LE.5)  GO TO 40
1430 PRINT 37,NAMC(I)
1440 37 FORMAT(8H GOV OF ,A4,32H IN ERROR, PLEASE ENTER GOV TYPE  )
1450 READ 39,K
1460 39 FORMAT(I1)
1470 GO TO 36
```

The dummy variable IG, representing regime type, is set.

```
1480 40 IG(K)=1
```


The following indicators of U.S., Soviet, and Chinese interaction with country I are set.

BEH = sum of cooperative behavior

REL = U.S. military and economic aid to I relative to that given by the Soviet Union

ARM = 5-year average of arms transfers

MLA = 5-year average of military aid

U = fraction of total military aid[1] given by the United States

S = fraction of total military aid[1] given by the Soviet Union

V = fraction of total military aid[1] given by China

[1] Arms transfers for Europe.

```
1490 BEH=USC(I)+SUC(I)+CHC(I)
1500 REL=(USA(I)+USM(1,I))/(SUA(I)+SUM(1,I)+1.)
1510 UT=0.
1520 ST=0.
1530 CT=0.
1540 UM=0.
1550 SM=0.
1560 CM=0.
1570 DO 100  J=1,5
1580 UT=UT+UST(J,I)
1590 ST=ST+SUT(J,I)
1600 CT=CT+CHT(J,I)
1610 UM=UM+USM(J,I)
1620 SM=SM+SUM(J,I)
1630 CM=CM+CHM(J,I)
1640 100 CONTINUE
1650 DO 142 JJ=1,4
1660 JH=6-JJ
1670 JL=JH-1
1680 UST(JH,I)=UST(JL,I)
1690 USM(JH,I)=USM(JL,I)
1700 SUT(JH,I)=SUT(JL,I)
1710 SUM(JH,I)=SUM(JL,I)
1720 CHT(JH,I)=CHT(JL,I)
1730 CHM(JH,I)=CHM(JL,I)
1740 142 CONTINUE
1750 ARM=UT+ST+CT
1760 XARM=ARM
1770 IF (XARM.EQ.0.) XARM=1.
1780 MLA=UM+SM+CM
1790 XMLA=MLA
1800 IF (XMLA.EQ.0.) XMLA=1.
1810 U=UT/XARM+UM/XMLA
1820 S=ST/XARM+SM/XMLA
1830 V=CT/XARM+CM/XMLA
```

If the Alignment Report has been requested, these last three variables are packed into a single word in IAL.

```
1840 IF (KODR(4).NE.0) CALL PACK(I,U,S,V,IAL)
```

The military aid and arms transfer computations are completed.

```
1850 ARM=0.2*ARM
1860 MLA=0.2*MLA
1870 UST(1,I)=UT*.2
1880 SUT(1,I)=ST*.2
1890 CHT(1,I)=CT*.2
1900 USM(1,I)=UM*.2
1910 SUM(1,I)=SM*.2
1920 CHM(1,I)=CM*.2
```


The country's population and selected economic variables are updated and current values computed. From this point on, array AAA (1, I) contains the current value for country I of attribute AAA;[2] AAA (2, I) contains the value for the year immediately past, and so forth. For processing efficiency, a value used several times later may be retained in a local variable, AAAX. Thus, for example, the current population figure is stored in POP (1, I). It is also held as POPX for use in the equations to follow.

```
1930 POP(4,I)=POP(3,I)
1940 POP(3,I)=POP(2,I)
1950 POP(2,I)=POP(1,I)
1960 POPX=B(1,I)*POP(2,I)
1970 POP(1,I)=POPX
1980 CNS(2,I)=CNS(1,I)
1990 CNS(1,I)=B(2,I)*CNS(2,I)
2000 INV(2,I)=INV(1,I)
```

[2] When AAA represents any country attribute (POP, CNS, GDP, and so forth).

```
2010 INV(1,I)=B(3,I)*INV(2,I)
2020 TIM(2,I)=TIM(1,I)
2030 TIM(1,I)=B(4,I)*TIM(2,I)
2040 TEX(2,I)=TEX(1,I)
2050 TEX(1,I)=B(5,I)*TEX(2,I)
2060 TML(2,I)=TML(1,I)
2070 GDP(4,I)=GDP(3,I)
2080 GDP(3,I)=GDP(2,I)
2090 GDP(2,I)=GDP(1,I)
2100 GDPX=CNS(1,I)+INV(1,I)+TEX(1,I)-TIM(1,I)
2110 GDP(1,I)=GDPX
2120 GX=GDPX*.01
2130 GPOP(I)= GDPX/POPX
```

Various components of the defense spending equation are pre-set.

```
2140 A1=A(6,1)
2150 A4=A(6,4)
2160 A60=A(6,60)
2170 GO TO (105,103,104,440),KREG
2180 103 A1=DEX(1,I)
2190 GO TO 106
2200 104 K=KAD(I)
2210 RIV=DEX(2,K)-DEX(3,K)
2220 IF (K.EQ.0) RIV=0.
2230 IF (RIV.LT.0.) A4=.29
2240 GO TO 106
2250 440 RIV=0.
2260 IF (I.EQ.18.OR.I.EQ.24) A1=300.
2270 GO TO 106
2280 105 K=IRIV(I)
2290 IF (K.EQ.1) RIV=DEXW
2300 IF (K.EQ.2) RIV=DEXN
```

Military manpower is computed and adjustments made for the Middle East countries.

```
2590 MLM(2,I)=MLM(1,I)
2600 MLM(1,I)=A(JA,8)+A(JA,9)*PPX+A(JA,10)*DEX(2,I)+A(JA,11)*CNF(1,I)
2610&+A(JA,12)*RIV+A(JA,36)*GPOP(I)+A(JA,70)*MLA
2620&+A(JA,13)*DGPX+A(JA,14)*(DEX(2,I)-DEX(3,I))+A(JA,15)*MLM(2,I)
2630&+A(JA,16)*(DEX(1,I)-DEX(2,I))
2640 IF (KREG.NE.3) GO TO 172
2650 H=.0036*POP(1,I)
2660 IF (I.EQ.5.AND.MLM(1,I).GT.H) MLM(1,I)=H
2670 172 DFM=MLM(1,I)-MLM(2,I)
2680 IF (DFM.GT.0.) GO TO 170
2690 DFM=DFM/MLM(2,I)
2700 IF (DFM.LT.-.10) MLM(1,I)=.9*MLM(2,I)
2710 170 CONTINUE
```

Trade alignments with the United States, the Soviet Union, and China are computed. Voting intensity, VTR, and conflict, CNF, are updated.

```
2720 TUSX=A(6,17)+A(6,18)*GX+A(6,19)*USG+A(6,20)*VUS(I)+A(6,21)*PPX
2730 GO TO (210,220,230,340),KREG
2740 210 IF (VUS(I).GE.38.) GO TO 107
2750 TUSX=TUSX-A(6,17)
2760 IF (GX.LT.100.) TUSX=TUSX*.004
2770 IF (GX.GE.100.) TUSX=TUSX*.01
2780 107 IF (TUSX.LT.0.) TUSX=25.
2790 GO TO 108
2800 220 CONTINUE
2810 GO TO 108
2820 230 IF (I.EQ.11.OR.I.EQ.5) GO TO 108
2830 IF (PPX.LT.25.) TUSX=TUSX*.01
2840 GO TO 108
2850 340 CONTINUE
2860 108 CONTINUE
```

```
2310 IF (K.EQ.3) RIV=0.
2320 IF (I.EQ.6)  RIV=RIV+.01*DEX(2,24)
2330 IF (I.EQ.24) RIV=RIV+.01*DEX(2,6)
2340 IF (I.EQ.9)  RIV=RIV+.01*DEX(2,22)
2350 IF (I.EQ.22) RIV=RIV+.01*DEX(2,9)
2360 IF (I.EQ.11) GO TO 166
2370 IF (I.EQ.12) GO TO 166
2380 IF (I.EQ.22) GO TO 166
2390 GO TO 106
2400 166 A4=-.00095
2410 A60=.39
```

Current defense expenditure is computed, with adjustments for the various regions.

```
2420 106 DEX(1,I)=A1+A(JA,2)*GX+A(JA,3)*CNF(1,I)+A4*RIV+A(JA,5)*MLA
2430&+A(JA,6)*TML(2,I)+A(JA,7)*GPOP(I)*1000.
2440 PPX=POPX*.001
2450 GO TO (167,320,168,330),KREG
2460 167 IF (I.EQ.11) DEX(1,I)=DEX(1,I)*.01
2470 GO TO 169
2480 320 CONTINUE
2490 GO TO 169
2500 168 IF (I.EQ.5.OR.I.EQ.11) GO TO 169
2510 IF (PPX.LE.25.) DEX(1,I)=DEX(1,I)*.1
2520 GO TO 169
2530 330 IF (I.EQ.18.OR.I.EQ.24) GO TO 158
2540 IF (PPX.LT.20.) DEX(1,I)=DEX(1,I)*.1
2550 158 DQX=(DEX(1,I)-DEX(2,I))/DEX(2,I)
2560 IF (DQX.GT..1) DEX(1,I)=1.1*DEX(2,I)
2570 169 IF (DEX(1,I).LT.0.) DEX(1,I)=DEX(2,I)
2580 DGPX=DEX(1,I)/GDPX
```

```
2870 TSUX=A(6,22)+A(6,23)*GX+A(6,24)*SUG+A(6,25)*VSU(I)+A(6,26)*PPX
2880 IF (KREG.EQ.1) CALL TRAD(I,GX,K,TSUX)
2890 TCHX=A(6,27)+A(6,28)*GX+A(6,29)*CHG+A(6,30)*VCH(I)+A(6,31)*PPX
2900 IF (TCHX.LT.0.) TCHX=0.
2910 TOT=TUSX+TSUX+TCHX
2920 TUSX=TUSX/TOT
2930 TSUX=TSUX/TOT
2940 TCHX=TCHX/TOT
2950 CALL PACK(I,TUSX,TSUX,TCHX,ITR)
2960 TRDX=TOT/(TEX(1,I)+TIM(1,I))
2970 VTR(2,I)=VTR(1,I)
2980 TRD(I)=TRDX
2990 CNF(2,I)=CNF(1,I)
```

Except for China, the equations for voting alignment are specific to each region.

```
3000 VCH(I)=A(6,48)+A(6,49)*IG(3)+A(6,50)*TUSX+A(6,51)*IG(5)
3010 GO TO (110,112,114,116),KREG
```

Voting alignment: Europe

```
3020 110 K=IRIV(I)
3030 F=.13
3040 IF (K.EQ.2) F=-.13
3050 VUS(I)=A(6,38)+A(6,39)*IG(2)+F*ARM+A(6,41)*IG(4)+A(6,42)*TSUX
3060 G=76.67
3070 IF (K.EQ.1) G=25.
3080 VSU(I)=G+A(6,44)*IG(2)+A(6,45)*TCHX+A(6,46)*ARM
3090 GO TO 118
```

Voting alignment: Latin America

```
3100 112 IF (GOV(I).EQ.2.) GO TO 90
3110 AU=46.5
3120 AS=29.7
3130 AC=30.3
3140 GO TO 92
3150 90 AU=11.9
3160 AS=88.1
3170 AC=33.3
3180 92 VUS(I)=AU+A(6,39)*IG(2)+A(6,40)*TCHX+A(6,41)*IG(3)+A(6,42)*IG(5)
3190 VSU(I)=AS+A(6,44)*IG(2)+A(6,45)*TSUX+A(6,46)*TCHX+A(6,47)*REL
3200 VCH(I)=VCH(I)+AC-34.71
3210 GO TO 118
```

Voting alignment: *Mideast*

```
3220 114 CONTINUE
3230 VUS(I)=A(6,38)+A(6,39)*TUSX+A(6,40)*U+A(6,41)*IG(4)+A(6,42)*REL
3240 A43=A(6,43)
3250 IF (I.EQ.5) A43=35.
3260 VSU(I)=A43+A(6,44)*TUSX+A(6,45)*TCHX+A(6,46)*IG(3)+A(6,47)*REL
3270 GO TO 118
```

Voting alignment: Africa

```
3280 116 CONTINUE
3290 VUS(I)=A(6,38)+A(6,39)*U+A(6,40)*TSUX+A(6,41)*IG(1)+A(6,42)*IG(2)
3300 VSU(I)=A(6,43)+A(6,44)*IG(1)+A(6,45)*TSUX+A(6,46)*TCHX+A(JA,47)*REL
```

Voting alignment is not allowed to exceed 100. VTR is the average of values for the U.S., the Soviet Union, and China

```
3310 118 IF (VUS(I).GT.100.) VUS(I)=100.
3320 IF (VSU(I).GT.100.)VSU(I)=100.
3330 IF (VCH(I).GT.100.) VCH(I)=100.
3340 VTR(1,I)=(VUS(I)+VSU(I)+VCH(I))/3.
```

The current value of conflict is computed and not allowed to drop below 0.1.

```
3350 CNF(1,I)=A(JA,53)+A(JA,54)*CNF(2,I)+A(JA,55)*RIV+A(JA,56)*(DEX(1,I)
3360&-DEX(2,I))+A(JA,57)*DGPX+A(JA,58)*BEH
3370&+A(6,35)*TUSX
3380 IF (CNF(1,I).LT..1) CNF(1,I)=.1
```

Past values of COU (revolt for Europe) are updated.

```
3390  COU(5,I)=COU(4,I)
3400 COU(4,I)=COU(3,I)
3410 COU(3,I)=COU(2,I)
3420 COU(2,I)=COU(1,I)
```

Current values of turmoil and coup are computed.

```
3430 122 TML(1,I)=A(JA,64)+A(JA,65)*COUP+A(JA,66)*DGPX+A(JA,67)*MLA
3440&+A(JA,68)*TML(2,I)+A(JA,69)*TUSX
3450  CCX=A(JA,59)+A60*TML(1,I)+A(JA,61)*COUP+A(JA,62)*MLA
3460&+A(JA,63)*(GDP(3,I)/POP(3,I)+GDP(2,I)/POP(2,I)+GPOP(I))
3470&+A(JA,71)*TMLT+A(JA,72)*CNF(2,I)
3480 COU(1,I)=CCX-.6989
```

In the developing regions, coup is not allowed to become negative.

```
3490 IF (KREG.EQ.1) GO TO 130
3500 IF (COU(1,I).LT.0.) COU(1,I)=0.
```

(Note: Although the same variable names, COU and COUP, are used in the European equation, their meanings are redefined for Europe.)

End of this section.

```
3510 130 CONTINUE
```

If the Conflict Report has been requested, the coefficients for a linear relationship between the fraction of a nation's GDP going to defense and its GDP per capita are computed. Based on its GDP and POP, each nation's expected defense spending is computed. The Tension Ratio is the ratio of the expected to actual (that is, projected) defense spending.

```
3520 IF (KODR(4)) 18,18,131
3530 131 F=M
3540 SX=0.
3550 SY=0.
3560 SX2=0.
3570 SXY=0.
3580 DO 132  I=1,M
3590 X=GPOP(I)
3600 Y=DEX(1,I)/GDP(1,I)
3610 SX=SX+X
3620 SY=SY+Y
3630 SXY=SXY+X*Y
3640 SX2=SX2+X*X
3650 132 CONTINUE
```

```
3660 B1=SX*SX-F*SX2
3670 IF (B1.EQ.0.) B1=1.
3680 BB=(SX*SY-F*SXY)/B1
3690 AA=(SY-BB*SX)/F
3700 DO 134 I=1,M
3710 ZOT=(AA+BB*GPOP(I))*POP(1,I)
3720 TR(I)=100.*DEX(1,I)/ZOT
3730 134 CONTINUE
```

The forecast for the current year is finished. Program control returns to statement 18 (line 570) to check the change file.

```
3740 GO TO 18
```


The output file is saved and program execu'ion is terminated.

```
3750 9 STOP
3760 END
```

Subroutine IPUT

```
3770 SUBROUTINE IPUT(NAMC)
```

This subroutine is the interactive portion of the forecasting program. It is called to allow the user to specify the output.

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```
3780 COMMON DUMMY(36),IFLAG,ISRT,IPMAX
3790 COMMON/NAM/M,KODC(30),KODR(4),IAL(30),ITR(30),IVT(30)
3800 DIMENSION NAMC(30)
3810 DIMENSION NMC(15),NREP(4,4),NVAR(7,4)
3820 CHARACTER *1 IH,NO,IFRS,ISEC,INS
3830 CHARACTER *4 NREP,NVAR,NMC,HELP
3840 CHARACTER *4 NAMC
3850 DATA IH,NO,IFRS,ISEC/1HH,1HN,1HF,1HS/
3860 DATA NREP/"ECON","OMIC"," REP","ORT ","MILI","TARY"," REP","ORT "
3870&,4HALIG,4HNMEN,4HT RE,4HPORT ,4HCONF,4HLICT,4H REP,4HORT /
3880 DATA NVAR/"INV,","CNS,","TEX,","TIM,","GDP,","GPOP","    ",",DEX",
3890&",DEX","/GNP",",MLM,","DEX/","MLM,","MPOP"
3900&,"TRAD","E V,","OTIN","G AL","IGNM","ENT,","ARMS",",TM"
3910&,"L, C","NF, ","COU(","RVL)",", TN","    "/
3920 DATA NO/1HN/
3930 DATA HELP/4HHELP/
```

The output is organized into four reports: economic, military, alignment, and conflict. The user is asked about each in turn.

```
03931 NREP(1,1)="ECON"
 3940 DO 20 J=1,4
 3950 KODR(J)=0
 3960 14 PRINT 100,(NREP(K,J),K=1,4)
 3970 100 FORMAT(6H WANT ,4A4,2H )
 3980 READ 101,INS
 3990 101 FORMAT(A1)
```

If the user asks for HELP, the list of variables in the report is printed.

```
4000 IF (INS.NE.IH) GO TO 16
4010 PRINT 99,(NVAR(L,J),L=1,7)
4020 99 FORMAT(10A4)
4030 GO TO 14
```

Any response except HELP or NO is treated as an affirmative answer. (Note: Only the first letter of the user's answer is read. Any answer starting with the letter 'H' is treated as HELP; any answer starting with an 'N' is treated as NO.)

```
4040 16 IF (INS,NE,NO) KODR(J)=1
4050 20 CONTINUE
```


The user may choose the specific countries for which output will be printed. The allowed commands are: FIRST, to select the first 15 countries in the list for that region; SECOND, for the rest of the countries in the region (Note: No region has over 29 countries); INC, to specify individual countries. 'HELP' produces this information.

```
4060 22 PRINT 102
4070 102 FORMAT(32H ENTER COMMAND FOR COUNTRY CODES  )
4080 READ 101,INS
4090 IF (INS.NE.IH) GO TO 24
4100 PRINT 103
4110 103 FORMAT(" THE COMMANDS ARE *"/" FIRST : FOR THE FIRST 15 COUNTRIES"
4120&" SECOND : FOR THE 16TH AND ALL FOLLOWING COUNTRIES"/
4130&" INC : TO ENTER INDIVIDUAL COUNTRY CODES")
4140 GO TO 22
```

If the command FIRST or SECOND is chosen, the country codes KODC are set by the program.

```
4150 24 IF (INS,EQ.IFRS) GO TO 40
4160 IF (INS,EQ.ISEC) GO TO 50
```

If the user specifies INC, he is asked to enter the number of countries. The limit is 15.

```
4170 26 PRINT 104
4180 104 FORMAT(21H HOW MANY COUNTRIES )
4190 READ 105,NUMC
4200 105 FORMAT(I2)
4210 IF (NUMC,LE,15) GO TO 28
4220 PRINT 106
4230 106 FORMAT(27H MAXIMUM NO. COUNTRIES = 15 )
4240 GO TO 26
4250 28 PRINT 107,NUMC
4260 107 FORMAT(7H ENTER ,I2,14H COUNTRY CODES )
```


The country names (that is, 3-character codes) are entered by the user and the corresponding entries in the code array, KODE, are set.

```
4270 30 READ 108,(NMC(K),K=1,NUMC)
4280 108 FORMAT(15A4)
4290 IF (NMC(1),NE,HELP) GO TO 32
4300 PRINT 109
4310 109 FORMAT(" THE COUNTRY CODES ARE :")
4320 PRINT 108,NAMC
4330 GO TO 26
4340 32 DO 36  K=1,NUMC
4350 DO 34  I=1,M
4360 34 IF (NMC(K),EQ,NAMC(I)) KODC(I)=1
4370 36 CONTINUE
4380 GO TO 60
```

The entries in KODE are set for the FIRST or SECOND command.

```
4390 40 LS=1
4400 LE=15
4410 GO TO 52
4420 50 LS=16
4430 LE=M
4440 IF (LE,LT,LS) GO TO 90
4450 52 DO 54 I=LS,LE
4460 54 KODC(I)=1
```

The user is given a list of the reports and countries he has requested.

```
4470 60 PRINT 110
4480 110 FORMAT(" THE FOLLOWING REPORTS MAY BE PRINTED :")
4490 DO 62 K=1,4
4500 IF (KODR(K),EQ,1) PRINT 108,(NREP(J,K),J=1,4)
4510 62 CONTINUE
4520 PRINT 111
4530 111 FORMAT(" FOR THE FOLLOWING COUNTRIES :")
4540 DO 64  I=1,M
4550 IF (KODC(I)) 64,64,63
4560 63 PRINT 108,NAMC(I)
4570 64 CONTINUE
```

This section is finished. Control returned to the MAIN program.

```
4580 90 RETURN
4590 END
```

SUBROUTINE PACK

```
4600 SUBROUTINE PACK(I,X1,X2,X3,IX)
```

This subroutine is designed to pack three significant figures of positive values between 0 and 9.99 into single computer word.

Values outside this range are set to zero.

```
4610 COMMON DUMMY(36),IFLAG,ISRT,IPMAX
4620 DIMENSION IX(30)
4630 IF (X1.LT.0.) GO TO 20
4640 IF (X2.LT.0.) GO TO 20
4650 IF (X3.LT.0.) GO TO 20
4660 I1=X1*100.
4670 I2=X2*100.
4680 I3=X3*100.
4690 IF (I1.GT.999) I1=999
4700 IF (I2.GT.999) I2=999
4710 IF (I3.GT.999) I3=999
4720 IX(I)=I1*1000000+I2*1000+I3
4730 GO TO 90
4740 20 CONTINUE
4750 22 FORMAT(14H ERROR IN PACK  ,I2,1X,3F10.4)
4760 IX(I)=0
4770 90 RETURN
4780 END
```

SUBROUTINE TRAD

```
4790 SUBROUTINE TRAD(I,G,K,T)
```

This subroutine is called to modify trade between the Soviet Union and the European countries.

```
4800 COMMON DUMMY(36),IFLAG,ISRT,IPMAX
4810 IF (K.NE.2) GO TO 10
4820 F=.16
4830 GO TO 90
4840 10 IF (I.NE.7) GO TO 20
4850 F=.2
4860 GO TO 90
4870 20 IF (I.NE.19) GO TO 30
4880 F=.001
4890 GO TO 90
4900 30 IF (G-100.) 32,32,34
4910 32 F=.001
4920 GO TO 90
4930 34 IF (G-400.) 36,36,38
4940 36 F=.08
4950 GO TO 90
4960 38 F=.2
4970 90 T=T*F
4980 RETURN
4990 END
```

POSTPROCESSOR

The postprocessor

- Prints the output reports requested by the user, and
- Checks the conditions for a government change.

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```
00105 COMMON DUMMY(36),IFLAG,ISRT,IPMAX
00110 COMMON/NAM/M,KODC(30),KODR(4),IAL(30),ITR(30),IVT(30)
00120 DIMENSION NMC(15)
00130 DIMENSION IQN(125),Z(15,15),IZ(3,15),XZ(21,15,15),IXZ(21,3,15)
00140&,POP(30),NREP(4,4),PX(15)
00141 CHARACTER *4 NREP,IWW
00145 DIMENSION NAMC(30)
00150 DATA NREP/"ECON","OMIC"," REP","ORT ","MILI","TARY"," REP","ORT "
00160&,4HALIG,4HNMEN,4HT RE,4HPORT,4HCONF,4HLICT,4H REP,4HORT, /
00170 EQUIVALENCE (IQN(1),M)
00171 CHARACTER *4 NAMC,NMC
00172 CHARACTER  *10 IFILE
```

An arithmetic statement function is defined to compute annual percent changes in the dependent variables. A second function produces powers of 10.

```
00180 DIF(K,L,J,I)=100.*(XZ(K,J,I)-XZ(L,J,I))/XZ(L,J,I)
00200 EEX(K,N,I)=10.**(XZ(K,N,I))
```

The general information is used from the input file, 'OUTP'. (For definitions of the arrays, see the Forecasting Program listing.)

```
00210 IFILE="DIPP/OUTP;"
00220 CALL SUBATT(1,IFILE,1,0,ISTAT)
00230 READ(1) KREG,NY,IQN,POP,NAMC
```

The names of the countries for which reports will be printed and their 1970 populations are written to arrays NMC and PX.

```
00280 DO 40  I=1,M
00290 IF (KODC(I)) 40,40,38
00300 38 NC=NC+1
00310 NMC(NC)=NAMC(I)
00320 PX(NC)=POP(I)
00330 40 CONTINUE
```

NY is the number of years for which forecasts are computed. Including the initial year, 1970, there are data for (NY+1) years in the 'OUTP' file.

```
00340 NY=NY+1
```

Each year's output is written to a single record in 'OUTP'. The NY records are transferred to arrays XZ and IXZ.

```
00350 DO 50 K=1,NY
00351C            K INDEXES YEARS
00360 READ (1) IZ,Z
00370 DO 46 L=1,15
00371C            L INDEXES COUNTRIES
00380 DO 42 J1=1,15
00381C           J1 INDEXES VARIABLES
00382C 1,GDP/POP;2,INV;3,CNS;4,TEX;5,TIM;,6,GDP;7,DEX;8,MLM;
00383C 9,VTR;,10,TRD;11,TML;12,COU;,13,DEX/POP;14,CNF;15,TR,
00390 42 XZ(K,J1,L)=Z(J1,L)
00400 DO 44  J2=1,3
00410 44 IXZ(K,J2,L)=IZ(J2,L)
00420 46 CONTINUE
00430 50 CONTINUE
```


The initial year is 1970. Since there are no data for previous years included in the output file, percent differences for this year are set to the dummy variable, D.

```
00440 KYO=1970
00450 D=0.
```

The output reports are grouped by country. The major section of this program is the DO-loop indexed by I (lines 00460 to 01830). The economic report is printed first.

```
00460 DO 200 I=1,NC
00470 IF (KODR(1)) 60,60,52
00480 52 PRINT 100,(NREP(L,1),L=1,4),NMC(I),PX(I)
00490 100 FORMAT(/14X,4A4,5H FOR ,A4,17H 1970 POPULATION ,F8,1)
00500 PRINT 101
00510 101 FORMAT(1X,4HYEAR,5X,3HINV,7X,3HCNS,7X,3HTEX,7X,3HTIM,
00520&7X,3HGDP,4X,3HPCC,2X,4HGPOP,3X,3HPCC)
```

```
00530 X=XZ(1,1,I)*1000.
00540 PRINT 102,KYO,(XZ(1,L,I),L=2,6),D,X,D
00550 102 FORMAT(1X,I4,4(1X,F9.1),F10.1,1X,F4.0,F8.1,F4.0)
00560 DO 54 K=2,NY
00570 KO=K-1
00580 KY=KYO+KO
00590 D1=DIF(K,KO,6,I)
00600 D2=DIF(K,KO,1,I)
00610 X2=XZ(K,1,I)*1000.
00620 PRINT 102,KY,(XZ(K,L,I),L=2,6),D1,X2,D2
00630 54 CONTINUE
```

The military report

```
00640 60 IF (KODR(2)) 70,70,62
00650 62 PRINT 100,(NREP(L,2),L=1,4),NMC(I),PX(I)
00660 PRINT 103
00670 103 FORMAT(1X,4HYEAR,5X,3HDEX,4X,3HPCC,1X,7HDEX/GDP,1X,3HPCC
00680&,1X,7HDEX/POP,1X,3HPCC,4X,3HMLM,4X,3HPCC,2X,7HDEX/MLM,2X,3HPCC)
00690 X1=XZ(1,7,I)
00700 X2=X1/XZ(1,6,I)
00710 X4=XZ(1,8,I)
00720 X5=X1/X4
00730 X4=X4*100.
00740 59 X5=X5*10.
00750 PRINT 104,KYO,X1,D,X2,D,XZ(1,13,I),D,X4,D,X5,D
00760 104 FORMAT(1X,I4,1X,F9.1,4(1X,F4.0,F8.2),1X,F4.0)
00770 D=0.
00780 DO 64 K=2,NY
00790 KO=K-1
00800 KY=KYO+KO
00810 X1=XZ(K,7,I)
00820 D1=DIF(K,KO,7,I)
00830 X2=X1/XZ(K,6,I)
00840 D0=XZ(KO,7,I)
00850 D2=D0/XZ(KO,6,I)
00860 IF (D2) 163,162,163
```

```
00870 162 D2=100.
00880 GO TO 164
00890 163 CALL DFF(X2,D2,D2)
00900 164 D3=DIF(K,KO,13,I)
00910 X4=XZ(K,8,I)
00920 D4=DIF(K,KO,8,I)
00930 X5=X1/X4
00940 D5=D0/XZ(KO,8,I)
00950 IF (D5) 167,166,167
00960 166 D5=100.
00970 GO TO 168
00980 167 CALL DFF(X5,D5,D5)
00992 168 X4=X4*100.
01000 X5=X5*10.
01010  PRINT 104,KY,X1,D1,X2,D2,XZ(K,13,I),D3,X4,D4,X5,D5
01020 64 CONTINUE
```

Alignment report

```
01030 70 IF (KODR(3)) 80,80,72
01040 72 PRINT 100,(NREP(L,3),L=1,4),NMC(I),PX(I)
01050 PRINT 105
01060 105 FORMAT(40H YEAR  TRD  PCC  TUS  TSU  TCH  VTR  PCC  ,
01070& 34H  VUS  VSU  VCH  ALUS  ALSU  ALCH  )
01080 DO 76 K=1,NY
01090 IF (K-1) 73,73,74
01100 73 D1=0.
01110 D2=0.
01120 KY=KYO
01130 GO TO 75
01140 74 KO=K-1
01150 KY=KYO+KO
01152 IF (XZ(KO,10,I),NE,0.) GO TO 174
01154 D1=0.
01156 GO TO 175
01160 174 D1=DIF(K,KO,10,I)
01170 175 D2=DIF(K,KO,9,I)
```

```
01180 75 CALL UPACK(IXZ(K,2,I),I1,I2,I3)
01190 CALL UPACK(IXZ(K,1,I),I4,I5,I6)
01200 T1=I1
01210 T2=I2
01220 T3=I3
01230 T4=I4
01240 T5=I5
01250 T6=I6
01260 T7=T1+T4
01270 T8=T2+T5
01280 T9=T3+T6
01290 PRINT 106,KY,XZ(K,10,I),D1,T1,T2,T3,XZ(K,9,I),D2,T4,T5,T6
013008,T7,T8,T9
01310 106 FORMAT(1X,I4,1X,F5.3,1X,F4.0,3F5.0,1X,F4.1,1X,F4.0,6F5.0)
01320 76 CONTINUE
```

The conflict report

```
01330 80 IF (KODR(4)) 200,200,82
01340 82 PRINT 100,(NREP(L,4),L=1,4),NMC(I),PX(I)
01350 IF (KREG-1) 83,83,84
01360 83 IWW=4HRVLT
01370 GO TO 85
01380 84 IWW=4HCOUP
01390 85 PRINT 107,IWW
01400 107 FORMAT(40H YEAR ARMUS ARMSU ARMCH TML    PCC  CNF  ,
014108,2X,3HPCC,2X,A4,3X,3HPCC,2X,3HTEN,4X,3HPCC)
01420 DO 89 K=1,NY
01430 IF (K-1) 86,86,87
01440 86 KY=KY0
01450 D1=0.
01460 D2=0.
01470 D3=0.
01480 D4=0.
01490 X1=0.
01500 X2=XZ(1,14,I)
01510 X3=0.
01520 X4=XZ(1,15,I)
01530 CALL UPACK(IXZ(1,3,I),I1,I2,I3)
```

```
01540 GO TO 88
01550 87 KO=K-1
01560 KY=KYO+KO
01570 X4=XZ(K,15,I)
01575 O4=XZ(KO,15,I)
01580 IF (KREG-1) 187,187,185
01590 185 X1=XZ(K,11,I)
01592 O1=XZ(KO,11,I)
01594 X3=XZ(K,12,I)
01596 O3=XZ(KO,12,I)
01610 GO TO 188
01620 187 X1=EEX(K,11,I)
01622 O1=EEX(KO,11,I)
01624 X3=EEX(K,12,I)
01626 O3=EEX(KO,12,I)
01630 188 X2=XZ(K,14,I)
01652 O2=XZ(KO,14,I)
01690 CALL DFF(X1,O1,D1)
01700 CALL DFF(X2,O2,D2)
01710 CALL DFF(X3,O3,D3)
01712 X4=XZ(K,15,I)
01714 O4=XZ(KO,15,I)
01720 CALL DFF(X4,O4,D4)
01790 191 CALL UPACK(IXZ(K,3,I),I1,I2,I3)
01800 88 PRINT 108,KY,I1,I2,I3,X1,D1,X2,D2,X3,D3,X4,D4
01810 108 FORMAT(1X,I4,3(1X,I5),4(F6.1,1X,F4.0))
01820 89 CONTINUE
01830 200 CONTINUE
```


Imports and exports are added to produce total trade for use in checking conditions for a government change.

```
01840 90 DO 92 I=1,15
01850 DO 92 K=1,NY
01860 92 XZ(K,4,I)=XZ(K,4,I)+XZ(K,5,I)
```

Subroutine CHECK is called for each country to determine if the conditions for a probable government change have been met during the period.

```
01870 CALL CHECK(NC,NY,XZ,NMC)
```

Program execution is terminated.

```
01880 STOP
01890 END
```

Subroutine UPACK

```
01900 SUBROUTINE UPACK(IW,I1,I2,I3)
```


This routine retrieves the three integers stored in one word by the PACK subroutine called by the forecasting program.

```
01910 I1=IW/1000000
01920 IWW=IW-I1*1000000
01930 I2=IWW/1000
01940 IWW=IWW-I2*1000
01950 I3=IWW
01960 RETURN
01970 END
```

Subroutine CHECK

```
01980 SUBROUTINE CHECK(NC,NY,XZ,NMC)
```

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```
01990 DIMENSION XZ(21,15,15),NMC(15),KVAR(4),KODE(4)
02000 DATA KVAR/13,11,1,4/
02010 DATA KODE/2,1,2,1/
```

KVAR contains the indices of the variables to be checked.

XZ (K, 13, I) = Defense spending per capita by country I for year K

XZ (K, 11, I) = Turmoil index for country I in year K

XZ (K, 1, I) = GDP per capita for country I in year K

XZ (K, 4, I) = Total trade for country I in year K

KODE = 1 indicates that positive changes lead to instability;

= 2 that negative changes increase instability.

Year K is the base year. D1 is the difference between K and the previous year. D2 is the difference between K and the next year. Thus, D1 and D2 represent two consecutive changes.

```
02020 NL=NY-2
02030 DO 40 I=1,NC
02040 DO 20 K=2,NL
02050 MSUM=0
02060 DO 10 L=1,4
02070 LV=KVAR(L)
02080 KL=K-1
02090 KN=K+1
02100 D1=XZ(K,LV,I)-XZ(KL,LV,I)
02110 D2=XZ(KN,LV,I)-XZ(K,LV,I)
```

Assignment of values to KODE (in the DATA statement above) indicates that positive changes in turmoil and trade and negative changes in defense spending and GDP per capita will produce instability.

```
02120 KK=KODE(L)
02130 GO TO (4,6),KK
 02140 4 IF (D1.GT.0..AND.D2.GT.0.) MSUM=MSUM+1
 02150 GO TO 10
 02160 6 IF (D1.LT.0..AND.D2.LT.0.) MSUM=MSUM+1
 02170 10 CONTINUE
```

If all four conditions are met, the year and country name are printed.

```
02180 IF (MSUM.LT.4) GO TO 20
02190 MYR=1970+KN
02200 PRINT 100,MYR,NMC(I)
02210 100 FORMAT(9H IN YEAR  ,I4,1X,A4,
02220&36H BECAME A CANDIDATE FOR A GOV CHANGE  )
02230 GO TO 40
02240 20 CONTINUE
02250 40 CONTINUE
```

When all countries have been checked, control is returned to the main program.

```
02260 RETURN
02270 END
```

Subroutine DFF

```
02280 SUBROUTINE DFF(F,G,D)
02290 X=F-G
02300 IF (G) 10,20,30
02310 10 G=-G
02320 GO TO 30
02330 20 D=0.
02340 GO TO 40
02350 30 D=100.*X/G
02360 40 RETURN
02370 END
```

This subroutine computes percent differences, D, between the current, F, of an output variable and last year's value, G.

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